

**FIELD PROCEDURE FOR COLLECTING
BRANCH DATA FOR SENSITIVITY ANALYSIS
OF TreeBLOSSIM**

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Report No. 115

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Stand Growth Modelling Cooperative

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NOTE : Confidential to participants of the Stand Growth Modelling Cooperative.
: This is an unpublished report and must not be cited as a literature reference.

Forest Research/Industry RESEARCH COOPERATIVE

EXECUTIVE SUMMARY

TreeBLOSSIM is an individual tree stem and branch growth model. The branching component has been developed by destructively sampling 85 radiata pine trees.

Two methods have been proposed for determining how well the branch component of this model performs for a wider range of sites and silviculture treatments. One approach is to use PhotoMARVL, which is a non-destructive technique providing quantitative data on branch position and diameter. The other approach is to use non-destructive inventory techniques to provide subjective data on branching characteristics.

This report outlines a non-destructive subjective inventory procedure that has been designed to be used in permanent sample plots to provide independent field data that can be compared with TreeBLOSSIM predictions of branching characteristics for that plot.

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INTRODUCTION

By March, 2003, 85 near-rotation-age radiata pine trees had been felled in order to develop the mathematical equations for predicting branching within TreeBLOSSIM (SGMC Report No. 108).

With any mathematical model, one cannot assume that it will give reliable predictions outside the range of conditions (in this case, genotype, site and silvicultural treatment) sampled to develop the model. For this reason, the next phase in the development of TreeBLOSSIM, is to determine how well it will perform for a wide range of genotypes, sites and silvicultural treatments.

Currently, two non-destructive options are being tested. One is to use PhotoMARVL for selected trees within a permanent sample plot (PSP), the other is to collect subjective inventory data for all trees within a PSP.

The advantage of PhotoMARVL is that it provides quantitative data. Currently it is the preferred option in trials where the differences in branching, between different treatments, are likely to be small (see SGMC Report Nos. 110, 116 and 117). Another option is to use it as a check where subjective inventory data and TreeBLOSSIM predictions do not agree.

The advantage of subjective inventory data is that it can be collected by the Cooperative members as an in-kind contribution to the Stand Growth Modelling Cooperative. This would allow us to get a broad overview of where TreeBLOSSIM performs well throughout the country.

The objective of this report is to outline a non-destructive inventory procedure that will allow output from some of the more important functions within TreeBLOSSIM to be compared with independent field data. The initial development and testing of this procedure is discussed in SGMC Report No. 109.

DATA COLLECTION PROCEDURE

This inventory procedure is to be used in permanent sample plots. The reason is that we can import PSP tree size measurements at any age into TreeBLOSSIM, and predict the branching pattern for the trees at that age. The trees can then be grown forward to the current age and the results compared with the field assessment of branching.

PSPs assessed should be at least 15 years old.

Site information required

- PSP measurement data
- Seed source (if available)
- Initial stocking of the plot
- Age of each thinning and stems/ha remaining after each thinning
- Pruning history (if available)

Variables to measure and record in the field

These variables need to be recorded for each plot

- Forest name
- Plot number (as recorded in the Forest Research PSP database system if applicable)
- Date of assessment
- Name of the person doing the assessment.

These variables need to be recorded for each tree

- Tree number
- Diameter at breast height (DBH)
- Total tree height
- Number of branches in the lowest cluster (Branch Count)
- Diameter of the largest branch in the first cluster (Branch Diameter)
- Height of first cluster (h_p)
- Height of the cluster nearest 12 m (h_{12})
- Number of branch clusters between height of first branch cluster and height of the cluster nearest 12 m (Cluster Count)
- Height to lowest live branch
- Height to lowest live cluster
- Stem defects i.e. is the tree forked, does it have multiple leaders or has lost its top at some stage
- Branch diameter class

It is suggested that the location of trees within the plot is mapped, if this has not been done earlier.

Field Form

The data is to be recorded on a field form as set out in (Table 1). This may also be set up as a spreadsheet on a field computer. This form includes the coding for the tree shown in Figure 3.

Variable Definitions

Cluster:

A “cluster” is equivalent to a “whorl” but is more correct term from a botanical perspective.

Branch count:

When counting the number of branches in the lowest cluster only the first order branches should be counted. First order branches are the branches that originate from the stem of the tree. Second order branches originate from the first order branches and over time the point of origin may be overgrown by the tree stem and can have the appearance of a first order branch. Second order branches are usually smaller than and close to the first order branch (see Figure 1).

Figure 1. Showing one first order branch (branch 71) and two second



Branch Diameter:

Estimated branch diameters are acceptable for this procedure. Some options to ensure that estimates are realistic:

- Carry a caliper and measure the occasional branch were possible to help keep your eye in.
- A few sections of sample branches with their diameter written on them may be carried.
- A caliper mounted on an extendable height pole could be used.

Height of first cluster (prune height) (h_p):

The prune height is to be the height of the first cluster above the pruning, this needs to be measured where the lowest branch joins the stem.

Branches that have formed after pruning from epicormics and are below the original prune height are not to be counted as the prune height.

Height of the cluster nearest 12 m (h_{12}):

This is the height of the closest cluster to 12 m on the tree, it may be more or less than 12 m. This is measured at the height where the lowest branch in the cluster joins the stem.

Cluster Count:

Count all of the clusters from the cluster nearest 12m down to the prune height. The count must include the clusters at both end-points.

A cluster with only one branch is to be counted as a cluster.

It is important not to miss clusters that may only have very small branches, (e.g. 2 – 3 mm diameters)

Within a cluster, there is a gradient in branch diameter with the smaller branches at the base and the larger branches at the top. Sometimes two clusters are very close together and at first glance appear to be one cluster (see Figure 2). You can tell whether it is one or two clusters by looking at the distribution of branch diameters. If the pattern of branch diameters from base to top of the cluster is small branches, large branches, small branches, large branches, then you should record two clusters. Small branches also tend to be more horizontal than the larger branches.

Lowest live branch:

This is the height of the lowest branch that has one or more green needles growing on it.

This is measured to the height where the branch joins the stem.

Lowest live cluster:

This is the height of the lowest cluster that has the **majority** of its branches alive.

This is measured to the height where the lowest branch in the cluster joins the stem.

Stem defects:

If a tree stem has broken off, is forked, is a multi leader, or has had a major leader break off below 12 m, then this tree is not to be recorded or measured for this assessment.

If a tree has one of the above listed defects at a height greater than 12 m, the tree is to be included. The defect code is to be recorded in the “Stem Defect Field” along with the height at which the defect occurs, e.g. FK 14.4 (see Table 1).

When assessing the branch size class on these trees stop at the point where the defect occurs.

Branch Diameter Class:

Branch diameter classes are assessed on the largest branch in each cluster, and are allocated into 2cm classes.

It is essential to assess the tree from the side where most of the large branches are visible.

Start from the “first cluster height” and work up towards the top of the tree. Given the difficulty of assessing branches high in the tree it is suggested that only branches below 20 m be assessed.

If the diameter of the largest branch at the first cluster height is 52mm, then it would fit into branch class “6” (branches between 4 & 6 cm). Working up the stem, record the height where the branch size increases or decreases outside of that class. Record the new diameter class size and then the height where it changes in the appropriate columns (see Table 1), until you reach 20 m or one of the listed defects that allows you to stop. Record the defect and its height in the defect code column (see Table 1).

By nature, branch size has a pattern of change every few clusters e.g. often a cluster with small branches will follow a cluster with large branches. As it is considered impractical to assess branch class on every cluster, the assessment must be done over sections of the stem with similar branch sizes and taking the pattern into account.

Another way to say this would be:

- Make certain that branch class is correct, i.e. the diameter of the largest branch in any length of stem should not exceed the upper limit of its allocated branch class.
- Don't change to a branch class smaller for the sake of a length of stem less than 2 m long.

Figure 2. Diagram showing heights that should be recorded in the subjective inventory procedure.

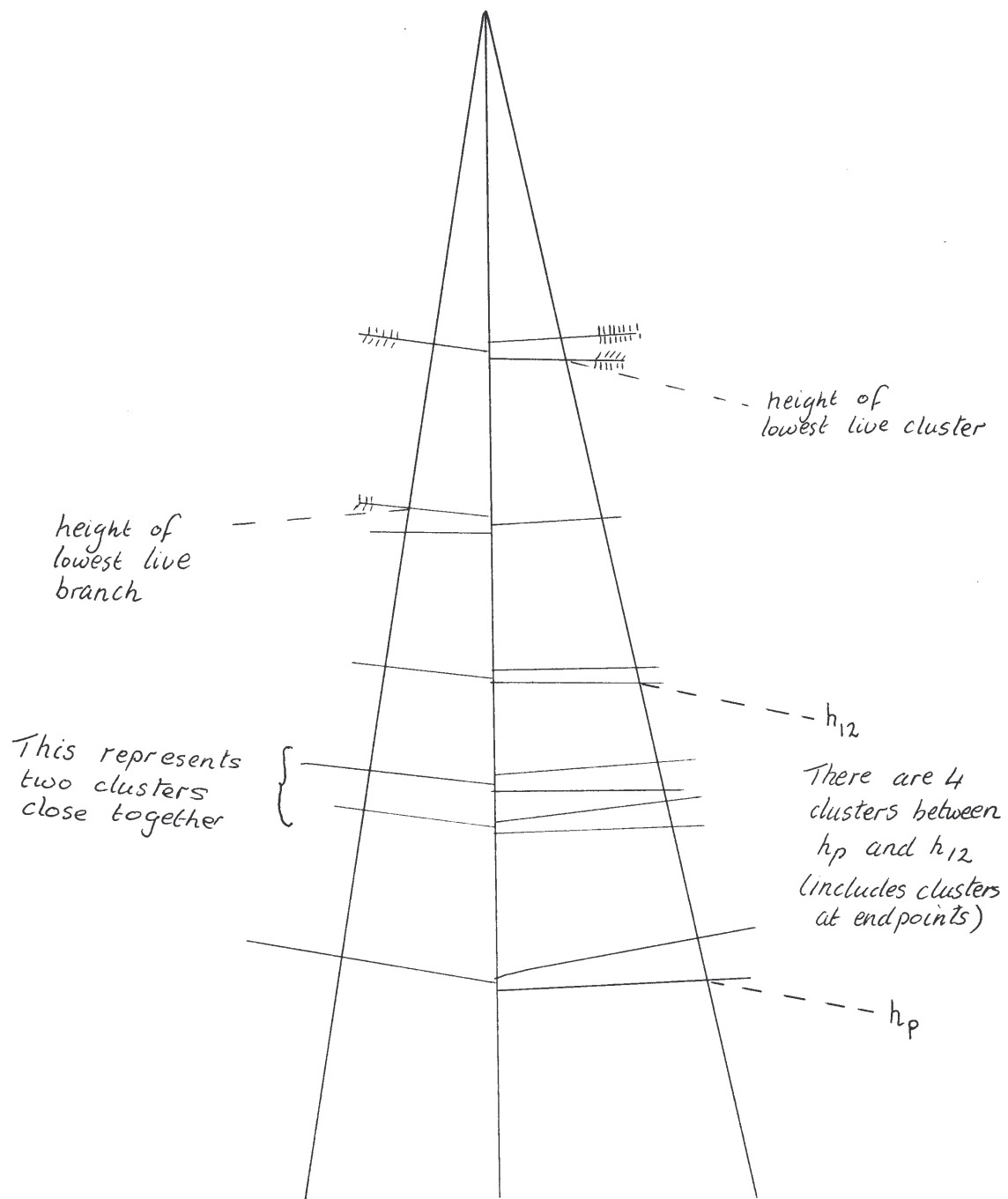


Figure 3 shows a graph of actual branch size measurements overlaid with a branch class assessment. The data of this assessment is recorded on the “Data Collection Form” (Table 1). In this case branches were assessed to the top of the tree. You will note that none of the actual branch measurements are greater than the branch class assigned for that section of stem, however there are a number of branches smaller. At the top of the tree you will note that there is a section of stem that could have been classed as a 2, this was not done as it gets very difficult to assess the top because of obscuring branches lower down the tree. For this reason we have decided to limit the section of stem assessed to below 20 m.

The branch class data on this tree is “perfect” so you can see what we are trying to achieve. The other two smaller graphs (Figure 4) are actual branch class assessments and are more typical of the accuracy that should be possible.

Figure 3. Diagram showing actual branch diameters and how branch classes should be recorded.

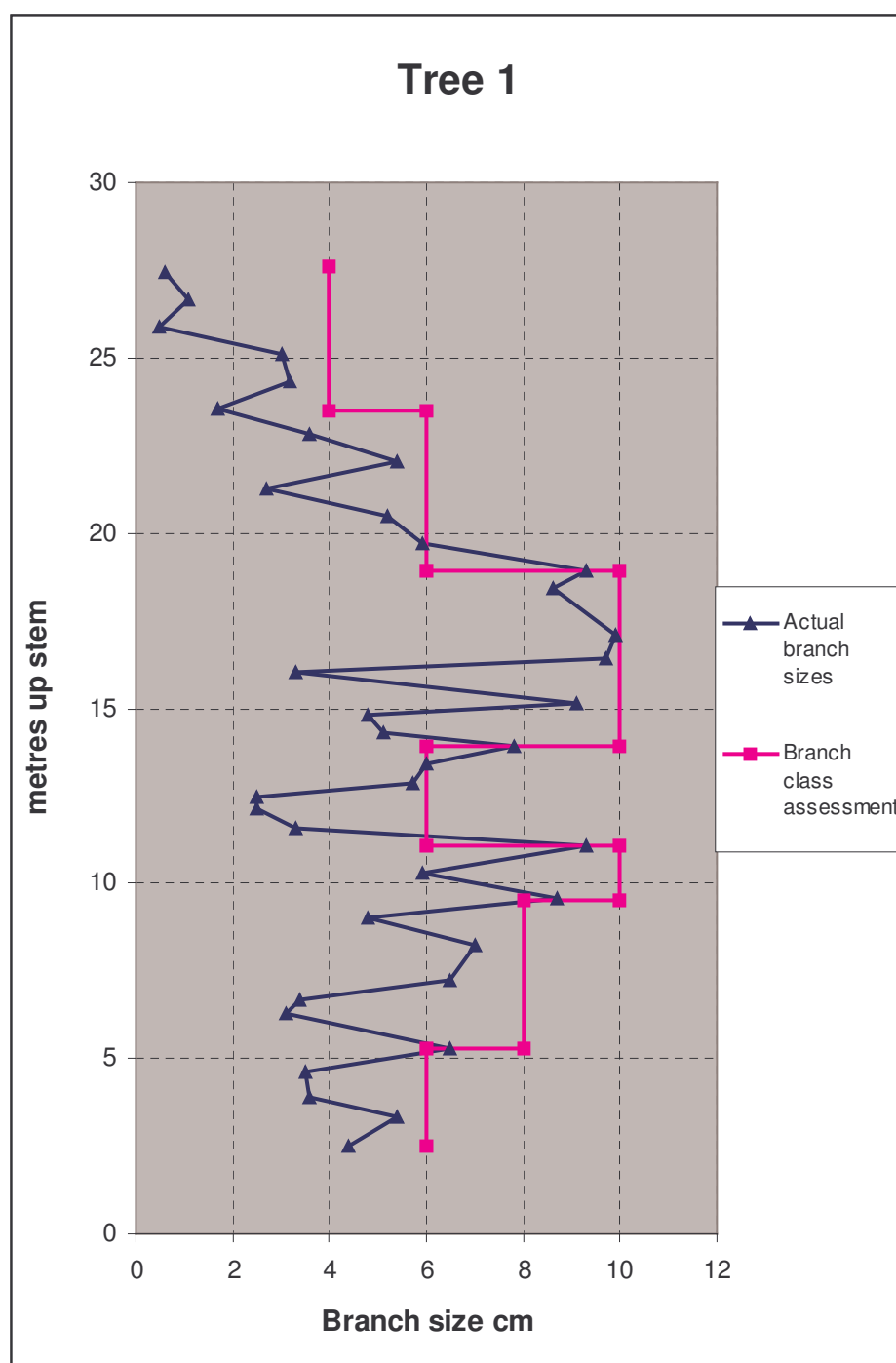
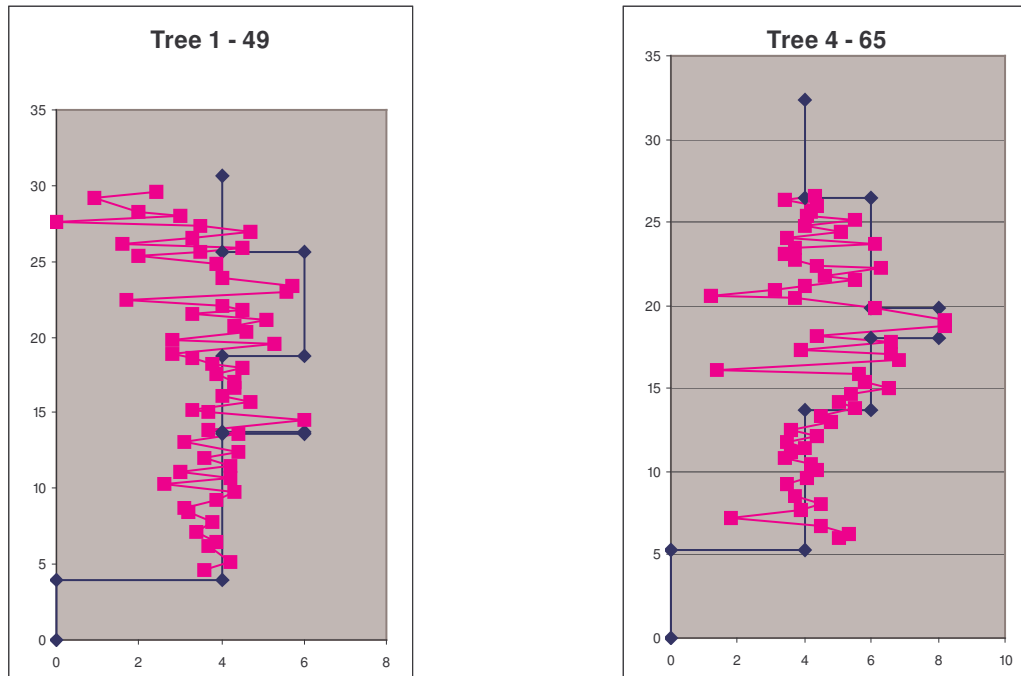


Figure 4. Actual branch diameters and branch class assessments for two trees, illustrating the accuracy that is achievable in the field. The vertical axis is the tree height in metres. The horizontal axis is the branch diameter in centimetres



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